

## CLAIMS

1. A target object position sensing apparatus for a host vehicle, the apparatus comprising:
  - 5 a lane detection apparatus provided on the host vehicle which includes an image acquisition means adapted to capture an image of at least a part of the road ahead of the host vehicle;  
a vehicle path estimation means adapted to estimate a projected path for the host vehicle;
  - 10 a target vehicle detection apparatus located on the host vehicle which is adapted to identify the position of any target objects located on the road ahead of the host vehicle, the position including data representing the distance of the target vehicle from the host vehicle;  
first data processing means adapted to determine a target lane in which
  - 15 the host vehicle will be located when it has travelled along the projected path by the distance to the target object;  
and second processing means adapted to compare the position of the target vehicle determined by the target vehicle detection means with the position of the target lane to provide a processed estimate of the actual position of the target object.
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2. The apparatus of Claim 1 in which the processed estimate comprises an indicator of whether or not the target vehicle is in the same lane as the host vehicle is projected to be in when at the point of the target vehicle.
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3. The apparatus of Claim 1 or Claim 2, in which the image acquisition means of the lane detection apparatus comprises a video camera which is adapted to produce at least one two-dimensional image of an area of the road in front of the host vehicle.
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4. The apparatus of any preceding claim in which the or each captured image is passed to an image processing unit.
5. The apparatus of Claim 4 in which the image processing unit is adapted to filter the or each image to identify artefacts in the image corresponding to at least one of the right hand edge of a road, the left hand edge of the road, lane markings defining lanes in the road, the radius of curvature of the lanes and the road, and the heading angles of the host vehicle relative to the road and lanes.  
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6. The apparatus of Claim 4 or Claim 5 in which the image processing unit is further adapted to perform a transformation algorithm, to convert the edge detected pointing of the lane boundaries from the image plane to the real world plane.  
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7. The apparatus of any one of Claims 4 to 6 in which the image processing unit is adapted to apply an edge detection algorithm to the or each image to detect lines or curves that correspond to lane boundaries.  
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8. The apparatus of Claim 7 in which the image processing unit is adapted to perform a tracking algorithm which employs a recursive least squares technique to identify the path of lanes in the or each image.  
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9. The apparatus of any one of Claims 7 or 8 in which the output of the image processing unit comprises data representing lane topography which is passed to the first data processing means.  
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10. The apparatus of Claim 9 in which the output of the image processing unit also includes information including the position of the host vehicle relative to the identified lanes and its heading.

11. The apparatus of any one of Claims 7 to 10 in which the first data processing means is adapted to determine which lane the host vehicle will occupy when it has travelled the distance to a target object by projecting the path estimated by the vehicle path estimation means with lane 5 boundary information at that distance.

12. The apparatus of any one of Claims 7 to 11 in which the vehicle path estimation means is adapted to use lane information to determine which lane the host vehicle is presently travelling in.

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13. The apparatus of any previous claim in which the vehicle path estimation means may estimate the path by projecting a path based upon the heading of the host vehicle.

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14. The apparatus of Claim 12 in which the projected path corresponds to the path of the lane.

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15. The apparatus of Claim 12 in which the vehicle path estimation means is adapted to predict that, if the processed image indicates that the host vehicle is towards a given side of a lane and heading towards that given side relative to the road the path estimation means may predict that the path of the host vehicle will continue for a short while to stay in that lane but will shortly change to a different lane to the given side.

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16. The apparatus of any preceding claim in which the vehicle path estimation means includes a yaw sensor which is adapted to determine the rate of yaw of the host vehicle in order to provide a measure of the radius of curvature of the path a vehicle is following.

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17. The apparatus of any preceding claim in which the target vehicle detection apparatus comprises an emitter which emits a signal outward in front of the host vehicle and a receiver which is adapted to receive a portion of the emitted signal reflected from objects in front of the vehicle, and a target processing means which is adapted to determine the distance between the host vehicle and the object.
18. The apparatus of Claim 17 in which the emitter and the receiver emit and receive one of radar signals and lidar signals.
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19. The apparatus of Claim 17 or Claim 18 in which the distance between the host vehicle and a target vehicle or object is determined by the target processing means based upon the time of flight of a signal from emission of the signal to receipt of a reflected portion of the signal.
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20. An adaptive cruise control system for a host vehicle comprising: sensing apparatus according to any preceding claim and signal generating means adapted to generate a steering bias signal which when applied to a steering system of the vehicle assists in controlling the direction of the vehicle so as to cause the host vehicle to track the target vehicle.
21. The control system of Claim 20 in which the signal generating means generates at least one vehicle speed control signal which when applied to a brake system or a throttle control system of the vehicle cause the vehicle to maintain a predetermined distance behind a target vehicle.
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22. The control system of Claim 20 or Claim 21 in which at least one of the signals is generated in response to the estimate of the target position determined by the sensing apparatus.
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23. The control system of any one of Claims 20 to 22 in which the control signals are only be generated for target vehicles that occupy the projected path of the host vehicle.